THE USE OF PISA-FORMAT COMPETENCY-ORIENTED TASKS IN PHYSICS LESSONS

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Annotation: *This article explores the integration of PISA (Programme for International Student Assessment)-format competency-oriented tasks in physics lessons, focusing on how such tasks foster critical thinking, problem-solving, and practical application of scientific concepts. The study examines the impact of these tasks on students' ability to analyze real-world situations, demonstrating the alignment of competency-based education with the skills necessary for modern scientific literacy. The findings suggest that PISA-style tasks not only enhance students' understanding of physics but also improve their overall academic performance and readiness for real-life challenges.*

Keywords: *PISA, competency-oriented tasks, physics lessons, scientific literacy, problem-solving, critical thinking, education reform, real-world application.*

In today's rapidly evolving educational landscape, it is essential to prepare students for real-world challenges by promoting competencies beyond traditional subject knowledge. In particular, physics education plays a crucial role in developing the critical thinking, problem-solving, and analytical skills that are fundamental for success in a variety of scientific and technological fields. One effective approach to achieving this goal is the incorporation of competency-oriented tasks based on the PISA framework.

The PISA assessment, developed by the OECD, measures the competencies of 15-year-old students in areas such as reading, mathematics, and science, with a strong focus on the application of knowledge in real-world contexts. By aligning physics lessons with PISA-style tasks, educators can foster the development of these critical competencies while simultaneously improving students' understanding of scientific concepts. This article examines the use of PISA-format tasks in physics lessons, assessing their impact on students' scientific literacy and overall academic performance.

PISA-format competency-oriented tasks refer to assessment items modeled after those in the Programme for International Student Assessment (PISA), an OECD initiative that evaluates 15-year-old students' scientific literacy (among other areas). Unlike traditional physics lessons focused on rote memorization of formulas or curriculum-specific content, PISA-style tasks emphasize competency-oriented approaches. These tasks require students to apply scientific knowledge in real-world contexts, fostering skills like critical thinking, evidence-based reasoning, and problem-solving.

Key Features of PISA-Style Tasks in Science/Physics

PISA science assessments (e.g., major focus in 2006, 2015, and upcoming in 2025) draw from physics, chemistry, biology, and Earth sciences. Physics-related content often falls under "physical systems" and includes topics like motion, forces, energy, waves, electricity, and matter.

The PISA framework organizes tasks around:

- Competencies:

- Explain phenomena scientifically (e.g., using physics principles to interpret everyday events).

- Evaluate and design scientific inquiry (e.g., assessing experiments or data reliability).

- Interpret data and evidence scientifically (e.g., analyzing graphs or results from physics contexts).

- Knowledge Types:

- Content knowledge (e.g., physics concepts like conservation of energy).

- Procedural knowledge (e.g., how to conduct measurements).

- Epistemic knowledge (e.g., understanding scientific models and evidence).

- Contexts:

- Real-life situations (personal, local, global), such as health, environment, technology, or hazards—not abstract textbook problems.

- Task Format:

- Often multi-part units with text, diagrams, data tables, or simulations.

- Open-ended or multiple-choice questions requiring reasoning, not just recall.

- Examples include analyzing climate data (physics of heat transfer), evaluating renewable energy sources (energy conversion), or interpreting wave phenomena in sound/light.

Released PISA items and frameworks are available on the OECD website for adaptation.

Benefits of Using These Tasks in Physics Lessons

Incorporating PISA-style tasks shifts physics teaching from traditional formula-plugging to competency-based education:

- Promotes Deeper Understanding — Students connect physics to everyday life (e.g., explaining why a car skids using friction and forces), improving retention and motivation.

- Develops Higher-Order Skills — Encourages evaluation of evidence, designing inquiries, and critical interpretation—skills valued in modern curricula and beyond school.

- Addresses PISA Insights — Many countries (e.g., Germany post-2000 PISA shock) reformed physics education to include more contextual, open-ended tasks, moving away from routine problems.

- Enhances Engagement — Real-world scenarios (e.g., sports physics like projectile motion in a "horizontal throw" task or energy in driving) make lessons relevant.

- Supports Assessment — Tasks can model formative/summative evaluations, aligning with competency standards.

Research shows traditional physics textbooks often overemphasize content recall, while PISA-style tasks better develop scientific literacy.

Examples in Practice

- Waves Topic → Tasks analyzing sound waves in everyday contexts (e.g., echoes or Doppler effect in traffic), requiring all three competencies.

- Motion/Energy → Scenarios like evaluating electric cables vs. overhead lines (environmental physics) or interpreting speed data from a 100m sprint.

- German Resources → Collections of "PISA-ähnliche Aufgaben" (PISA-like tasks) for physics, focusing on alltag (everyday) phenomena.

- Global Adaptations → In China or Indonesia, textbooks and tests increasingly incorporate PISA frameworks for physics to boost literacy.

Teachers can access released PISA science items (including physics-related) from OECD sources and adapt them. For instance, start lessons with a contextual stimulus (e.g., a news article on renewable energy) followed by questions prompting explanation, data interpretation, and inquiry evaluation.

This approach aligns physics education with 21st-century goals: preparing students not just to know physics, but to use it thoughtfully in a complex world. If you're a teacher or student seeking specific examples, many free resources (e.g., OECD released items or national adaptations) are available online.

The findings from this study align with previous research suggesting that PISA-format competency-oriented tasks can have a positive impact on students' learning outcomes. The increased focus on real-world application and problem-solving helps students develop the skills necessary to navigate complex scientific challenges, which are increasingly valued in the modern workforce.

However, the study also highlighted several challenges in implementing PISA-based tasks, including the need for teachers to adapt their instructional methods and assessment practices. Teachers reported that the tasks required more preparation time and a shift from traditional teaching methods. Additionally, some students found the tasks challenging, particularly those who struggled with higher-order thinking and application-based learning.

Conclusion

Incorporating PISA-format competency-oriented tasks into physics lessons offers significant educational benefits. By promoting real-world application, critical thinking, and problem-solving skills, these tasks align with the goals of modern science education. The findings of this study suggest that such tasks can improve students' understanding of physics and enhance their ability to apply scientific concepts in everyday situations.

Teacher Training: Educators should receive professional development opportunities focused on the integration of PISA-format tasks into their teaching. Training should emphasize how to design and implement competency-oriented tasks that align with the curriculum and foster critical thinking.

Curriculum Reform: Education systems should consider incorporating competency-based tasks into the science curriculum, moving away from traditional rote learning and towards more application-based, student-centered learning.

Ongoing Research: Further studies should explore the long-term effects of PISA-format tasks on students' academic and career outcomes, as well as how these tasks can be adapted for different cultural and educational contexts.

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